Can biodynamic farming

contribute to global warming to reduce?

A survey of organic farms in Sweden

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The carbon that is currently increasing in the atmosphere in the form of carbon dioxide can be sequestered by everything living that grows on Earth. The balance between the burning of carbon (fossil bound in oil, gas and coal deposits and as a component of soil and plants) and photosynthesis must be restored if we want to prevent a further increase in carbon dioxide in the atmosphere . At the climate conference in Paris in 2015, the then French Minister of Agriculture Stéphane Le Foll launched the so-called four per thousand target: an annual increase in the carbon stock in the soil by four per thousand could compensate for man-made emissions.

In addition, this would help to improve the fertility of the soil, its ability to bind water and compensate for drought to a certain extent and help to secure the food supply: the world population will reach 9.5 billion by 2050 gain weight. Global warming ultimately affects agriculture and food supplies. Both drought and floods are looming, as are weather disasters that are difficult to predict. At the same time, agriculture in particular offers opportunities to counteract global warming.

Climate-friendly Swedish project Agriculture

In the last two years , a project has been carried out at the Biodynamic Research Institute at the Rudolf Steiner University in Järna1 that shows to what extent agriculture and food supply would have to be fundamentally changed in order to achieve the climate goals under Swedish conditions. Because of the different climate and soil types, the conditions here are of course different than in the rest of Europe. In Sweden, agriculture and food supply contribute 16% of the consumption-based burden of greenhouse gases. This includes imported fuel, mineral fertilizers and animal feed.

In order to achieve the climate target, the climate impact per person must be reduced by more than 90% within 30 years. In relation to the food sector, this means a reduction from today's 1.4 t CO2 to 140 kg per capita. This would require radical changes to the entire agriculture sector: more pasture cultivation on arable land, a higher degree of self-sufficiency without importing mineral fertilizers and animal feed, and a minimum of imported food. This emerges from a new study on biodynamic and ecological example farms (Granstedt and Thomsson, 20212).

A total of 22 farms across Sweden have been examined in the last two years. They practice what we call organic circulation farming. This concept is based on the principle of biodynamic agriculture, according to which each farm forms a self-sufficient unit, independently or in collaboration with one or more neighboring farms, so that the farm functions as an organism3 .

In the Baltic Sea project BERAS (Building Ecological Regenerative Agriculture and Society), typical farms in all Baltic Sea countries showed that the switch to such agriculture is necessary in order to prevent over-fertilization To stop nutrient salts4 . of the Baltic Sea. The importance of such a switch for the climate was also shown here . >>>

“These farm studies show the great potential for reducing the climate impact of agriculture through appropriate farming practices.”

Of the 22 sample farms in the new study, 7 are biodynamic in the sense that they also use biodynamic preparations. However, the concept is common to all farms. Each farm is essentially an agricultural organism without purchasing climate-damaging resources such as imported mineral fertilizers, animal feed and soy from countries where they lead to deforestation and soil destruction, unlike specialized conventional agriculture. All farms have large areas of perennial meadows and pastures with a high proportion of fodder legumes, which bind nitrogen through symbiosis and carbon through photosynthesis. Their deep roots also accumulate carbon and organic matter in the soil.

A number of the farms also have extensive vegetable cultivation, either separately or, as with some farms, as an integrated part of the crop rotation. All farms are up to 85% self-sufficient in feed and do not purchase any nutrients for fertilization. The farms are representative of different types of farms and climate zones in Sweden, each within the framework of the basic concept of organic circulation agriculture: All of them provide themselves with feed and fertilizer, if necessary in close cooperation with other farms.

The nutrient balances and climate calculations are based on data collected on the farms and calculated using the Swedish Agricultural Administration's standard program “Greppa näringen”. This was supplemented by calculations of soil carbon sequestration based on isotope carbon studies that modeled sequestration as part of the Farmland Ecology project at the Swedish Agricultural University. As a result, 35% of the carbon in the organic matter added to the soil was converted into more stable organic substances5 .

Several long-term studies and inventories of the contents of Swedish soils confirm these results6, 7. Possible contributions to humus formation through natural grazing within the farms were not taken into account.

Eco-circulation economy reduces Climate impact significant

The results of the survey on the farms show that Climate impact measured in CO2 equivalent compared to average Swedish agriculture is over 90% lower

Fig. 1: CLIMATE EFFECT OF ORGANIC FARMING: SIGNIFICANTLY REDUCED

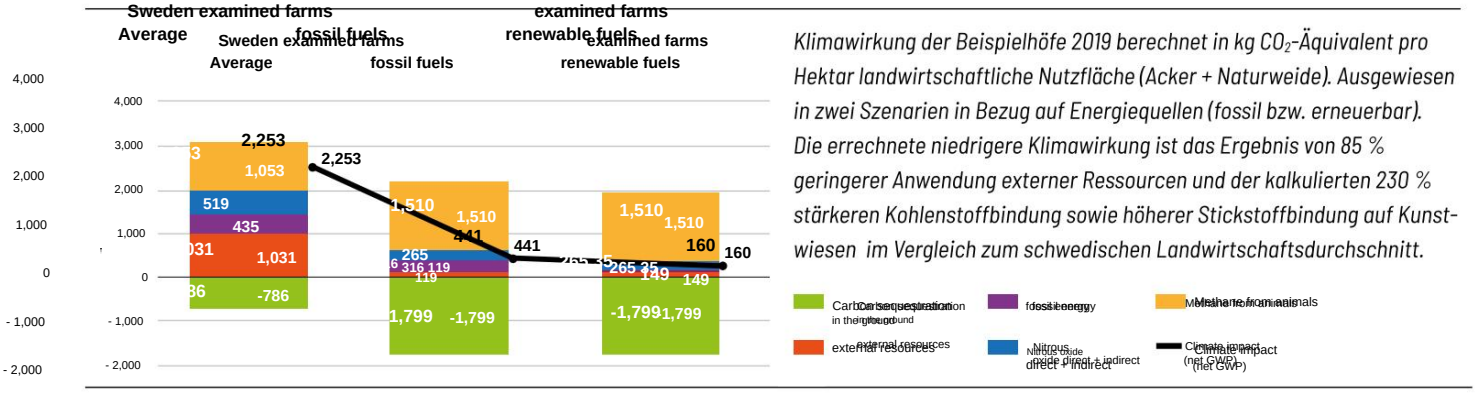


Fig. 2: CLIMATE BALANCE: MORE BONDING OF CO2 EQUIVALENTS THAN EMISSIONS

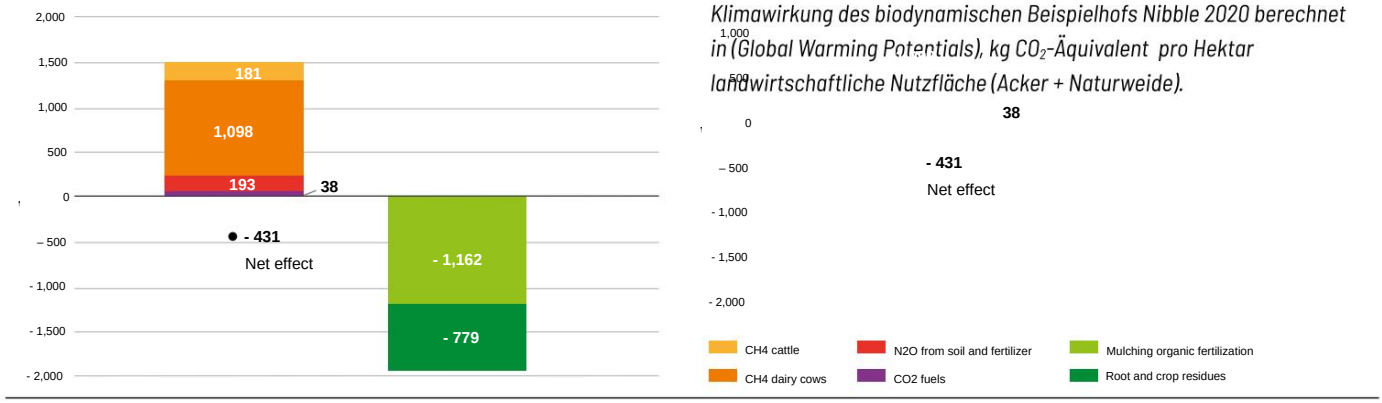
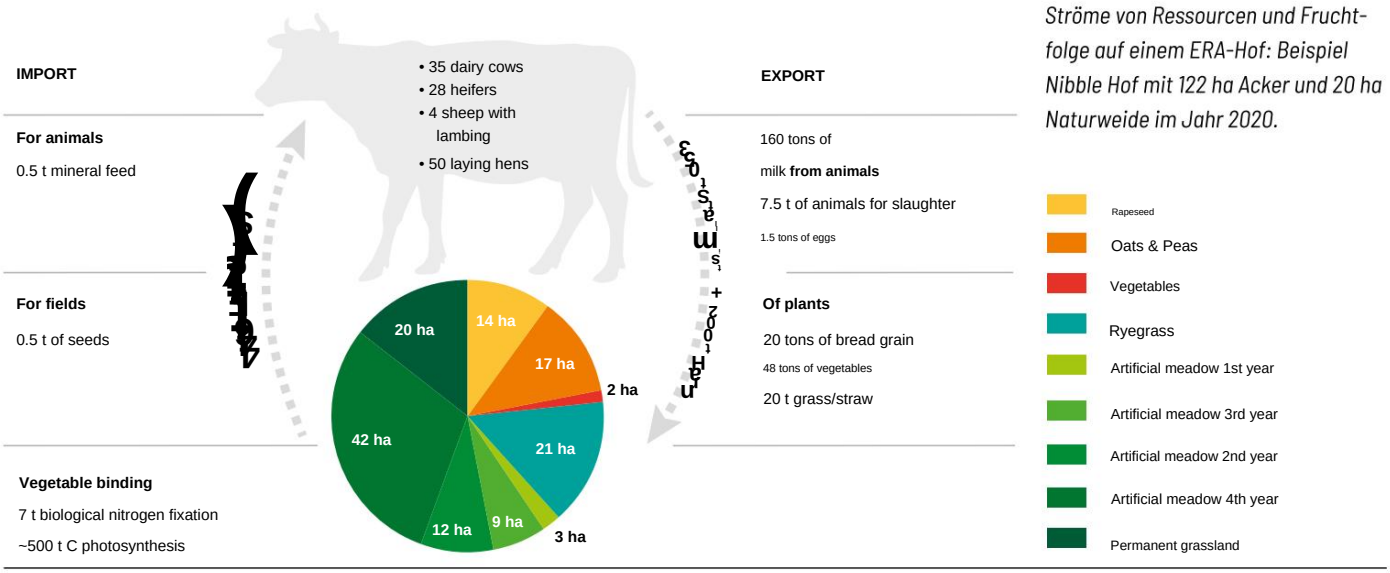


Fig. 3: RESOURCE FLOWS AND FRUIT SEQUENCE HOF NIBBLE



ger and the nitrogen surplus in the nutrient balance is more than halved: between 6 to 10 kg N/ha per year on the farms examined, 19 kg N/ha per year on average in Sweden.

These farm studies show the great potential for reducing the climate impact of agriculture through appropriate farming practices (Fig. 1). Since these farms are entirely self-sufficient and only use coarse fodder (grass and legumes), this form of agriculture represents a “carbon sink”: That is, it helps to reduce carbon dioxide in the atmosphere (Fig . 3) shows the plant nutrient flows of the biodynamic example farm Nibble with its coarse feed-based milk production via purchasing, in-house production, “recycling” and the loss through sales. The calculated carbon storage here is greater than the emission of greenhouse gases (Fig. 2).

Other farming means

other eating habits

The project designed various scenarios for a future food supply that is adapted to the climate and based on the production of our example farms. They show that meat consumption must decrease and animal husbandry must rely more on coarse feed. This would roughly correspond to the consumption levels in Sweden in the 1960s, when the country still largely relied on its own food. At that time, meat consumption per capita was 42% lower than in 2019 and was based to a slightly larger extent on meat from ruminants today. A change according to our scenarios also brings with it a significantly higher production and consumption of horticultural products. Today's levels of production and consumption of poultry (chickens) and pork are incompatible with these scenarios. It is unclear whether we have time for such a change in order to adapt production and consumption in the food sector to the climate.

Relevance of biodynamics

for the humus content

The principles of ecological circulation agriculture that have been described here correspond to the agriculture that Rudolf Steiner gave in his agricultural course at Pentecost 1924 in Koberwitz in what is now Poland and which are now widespread under the name “biological-dynamic cultiva This form of cultivation can be seen as a further development of the crop rotation system that was introduced in parts of Europe at the beginning of the 20th century. From there, however, it is a significant step towards a self-sufficient agricultural organism and a full application of biodynamic farming as practiced on seven of the project's example farms. We know from various field tests that the use of biodynamic preparations can lead to an even higher build-up of organic matter than has been calculated in experiments within conventional agriculture.

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In 2002, the journal Science published the results of the so-called DOK experiment. For eighteen years, three farming systems had been compared: biodynamic (D), organic (O) and conventional (K). The organic matter in the form of organically bound carbon was higher in biodynamic cultivation than in organic fertilization without composting and without the use of biodynamic preparations. The biological activity in the form of soil respiration and enzyme activity is also highest in the biodynamic stage. The images of the soil surface clearly demonstrated that the soil structure is better. Results of previous field tests were confirmed here.

Corresponding results from long-term experiments had already been published in 1987 in a report by the biodynamic research institute in Darmstadt8, followed by a doctoral thesis in 1996 at the University of Giessen. In this experiment, Johann Bachinger was able to show that the root biomass is greater with biodynamic treatment.9 There seems to be a connection between stronger root formation and the build-up of organic matter, i.e. better binding of carbon in the soil when used of specifically biodynamic treatments.

In a 32-year experiment that began in Järna in 1958 to compare biodynamic, organic and conventional agriculture and was carried out throughout life by Bo D. Pettersson, a higher humus content in the form of organic carbon was achieved in the soil in 1992 the biodynamic variant can be proven10.

These results are confirmed by other results, e.g. B. through experiments at the biodynamic research institute in Järna11, as well as through experiments at two locations in the USA under the direction of Walter Goldstein12. The American studies also included root studies that demonstrated the connection between application of biodynamic preparations and a higher build-up of organic matter in the soil. Increased root development and increased buildup of organic carbon in the soil can be attributed to photosynthesis. The use of biodynamic preparations seems to increase the utilization of light, which Manfred Klett showed in his research as early as 196813.

The criteria of scientifically based knowledge are met here both in terms of statistically reliable results through randomized experiments and through the repeatability of independent experiments. The results of the Swedish tests were presented in Living Earth 3/2019. They showed a 50% higher organic matter buildup when treated biodynamically with both composting and biodynamic preparations. The unique thing about these experiments is that they were carried out within a farm organism using the farm's own fertilization. This agrees with Rudolf Steiner's description that every farm is unique and always evolving. The fruits grown on the farm provide feed for our own animals, the fertilizer from which is fed back into the farm. Biodynamic cultivation with composting and the use of biodynamic preparations resulted in an annual humus increase of 7.5 per mille. It can be assumed that biodynamic cultivation on all cultivated areas would make a significant contribution to reducing the impact of humans on the climate. •

Sources

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Elements of organic circulation agriculture are: •Versatile cultivation sequences with humus-building, perennial, deep-rooting, nitrogen-fixing pasture plants that compensate for the mineralization of soil organic matter;

•integrated animal husbandry – the farm's own feed production or those working together Farms adapted for closed circulation of organic matter and plant food;

•Handling of manure at farm level with the lowest possible losses of organic matter substance and plant food;

•Soil use that promotes organic matter, i.e. sequesters carbon, which organisms and Promotes soil fertility.

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